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THE TELEPHONE COMPANY AND THE NEW TELEGRAPH BILL.

A PETITION has been presented to Parliament by the Telephone Company of London, praying the House of Commons not to pass the New Telegraphs' Bill as it now stands, on the ground that it would confiscate the Company's property, and deprive the Bell Telephone patentees of the fruits of many years labour and study, and begging that the said Bill may be referred to a select committee who should examine the question at issue. This action has been taken by reason of Clause 3 in the New Telegraphs' Bill. By that clause it is proposed "that in the construction of the Telegraph Act of 1869, the term "telegraph" shall in addition to the meaning assigned to it by that Act, include any "apparatus for transmitting messages or other communications with the aid of electricity, magnetism, or any other like agency." It is clear that this clause covers the telephone, and the Telephone Company are reasonably afraid that the Government monopoly will appropriate their inventions and shut them out from their own use of it. In their own words they "apprehend that the introduction of the 3rd clause into the now pending Bill has been designedly done by the Post Office, for the express purpose of obtaining a monopoly of so much of the Company's business, as would be in competition with the Post Office Telegraphs," and "that the effect of the said Clause 3 would be to give the Postmaster-General not only the right of using the telephone, without payment of any compensation whatever to the owners of the patents, but also of prohibiting your petitioners from supplying telephone communication themselves." An arrangement between the Company and the Post Office at present exists whereby 60 per cent. of all rentals from postal telephone lines is handed over to the Company, and it is feared that Clause 3 will enable the Post Office to evade this royalty. In fine, the Telephone Company naturally fear that the Government monopoly will not only abolish all competition on their part, but likewise accord them insufficient compensation.

An annex to the petition sets forth the aims and scope of the Telephone Company, who at great expense have purchased Professor Bell's patent. "Telephonic lines," says this document, "might for instance be erected between the Temple, or the various Inns, and Westminster, for the benefit of barristers and solicitors frequenting the different Courts. These would be connected with a *central station*, say for instance, in the Strand, from which branch lines would diverge to the different chambers or offices. The whole would be the property of the Company, and the operation would be as follows:—A barrister at Westminster would come to the Telephone Office, and say he wished to speak with the clerk at his chambers. This information would be conveyed to the central station, where they would at once switch on the special branch wire connected with these chambers, and thus afford the parties the advantages of direct private verbal communication, without any loss of time." A similar plan is likely to be of great service to shipowners, merchants, manufacturers, and bankers, enabling them to communicate vocally with their agents at docks, wharves, or branch establishments; and as a household telegraph it would prove very accommodating. In the same way "different towns may be joined together," so runs the annex, "such as Manchester, Liverpool, Glasgow, and London. A Manchester merchant, for example, now requires to come to London to see some one on business. He consumes 10 hours, at least, in travelling, has to spend one night in town, and is at heavy expense, apart from the loss of valuable time. On the other hand he can arrange that he and his correspondent shall be at the Telephone Offices at a certain time, and thus settle their business by direct *viva voce* communication." These examples serve to show how wide the field for the telephone undoubtedly is, and how important and valuable it may become in the future.

While admitting that the Telephone Company have excellent grounds for the action they have taken, we will not go so far as to say that the offending clause has been specially levelled at them. It appears to us to have a more general bearing, and to be designed to correct the narrow phraseology of the old Act. We understand that Bill to limit its definition of "telegraph" to all instruments which make "signals"; doubtless because at the time it was drawn up, no one anticipated a telegraph which would act without some kind of signals. The invention of the speaking telephone has opened the eyes of our legislators. It is now seen that there may be modes of telegraphing without signals, and the old phraseology requires to be expanded so as to take in these, and provide for the future as well as the present. However, it must be confessed, that by the showing of the Telephone Company themselves, the telephone might become a formidable rival to the Government telegraphs. If long telephone lines ramify the country throughout its length and breadth, there will be a telegraph system within a system, each competing with the other, and a strict Government monopoly will no

longer exist. It is also conceivable that some new invention, now totally unexpected, might outstrip the existing complex systems, and leave their cumbersome paraphernalia stranded and obsolete on the shoals of telegraphic time. What then would become of the Government monopoly for which £10,000,000 were paid? Obviously it is prudent for the Postmaster-General to alter the wording of his charter, and stretch the old formula to meet not only the new facts, but the new possibilities. The vagueness of the altered language excites our admiration; "by aid of electricity, magnetism, or any other like agency," is a phrase whose comprehensive vagueness is worthy of Russian diplomacy.

It is satisfactory to know that the conflict between the Telephone Company and the Government is in a fair way of being settled. A deputation of members of Parliament, and others interested in the development of telegraphy, waited recently on the Postmaster-General, and conferred with him upon the subject. The Postmaster-General was understood to say, that the general question that had been raised by some speakers, as to whether it was or was not right that the Government should have a monopoly must be set aside, as that question had been determined by Parliament when the telegraphs were taken over by the Government. Dealing with the special case brought before him by the deputation, he disclaimed on the part of the Government any knowledge of the fact that a private Company had been formed when the Bill was introduced into Parliament, but held out the hope that a friendly conference of those interested in the matter with himself, might result in some modification of the existing clause.

In coming forward as they have done, the Telephone Company have not only asserted their rights, but rendered a service to the electrical profession in general. The obnoxious Clause 3 as it stands, is, as Mr. Sullivan pointed out to the Postmaster-General, a dangerous blow at telegraphic invention in this country. The Government have acquired a monopoly of the telegraphs which is on the whole a benefit to the public at large; but at the same time it should not be allowed to become an oppression to inventors. In the end it is for the public good that it should not become so. But what would an absolute monopoly over all possible telegraphs as claimed by the said clause be, but a despotism to inventors? Regarded superficially, it may seem a harmless thing, but like all rights in the grasp of power, it would soon prove high-handed. The English inventor who felt that there was only one purchaser for his invention in England—the Government monopoly—and that he must either take what it chooses to offer him, or want, would very soon cease to invent, and telegraphic invention would languish in this country even more than it does at present. Monopolies, even Government ones, carry in them the seeds of evil; but these seeds, by wise and careful management, may be prevented from germinating. It will now lie with the Postmaster-General to see that the New Telegraph Bill recognises the rights of inventors, and encourages their efforts by a prospect of fair remuneration.

THE INVENTION OF THE MICROPHONE.

THE *New York Daily Tribune* of June 27 contains the following reply of Mr. Edison to the joint telegram of Mr. W. H. Preece and Prof. Hughes categorically denying the piracy of invention which Mr. Edison imputed to them. This telegram was published in our issue for July 1, and it is necessary that we should give Mr. Edison's answer to it, and the proofs of his case.

To the Editor of the *Tribune:*

Sir,—In reply to the card of Messrs. Preece and Hughes, regarding the piracy by the latter of my carbon telephone, as contained in your paper of this date, allow me to refute their statements by their own words, and by extracts from the English scientific papers. I quote from their card:

"Hughes has not brought out any thermopile.

"W. H. PREECE."

"I emphatically indorse every word of the above message.

"D. E. HUGHES."

From *The Engineer*, May 17, 1878:

"Professor D. E. Hughes's telephone, microphone, and thermopile. . . . A discovery not made till after Professor Hughes's paper was read before the Royal Society, points out another field of usefulness for this instrument. We all know what excellent service the thermopile has done in the hands of Professor Tyndall and other investigators of heat, but we think we may safely describe another kind of thermopile, as sensitive and far less complicated, less difficult to construct, and less expensive than that compounded of zinc and antimony in the usual fashion. Instead of the glass tube as described, Professor Hughes was experimenting with a quill, and found that the instrument was exceedingly sensitive to heat. On the approach of a warm hand the galvanometer needle swings violently in one direction; on cooling the tube it swings in the other."

Again, I quote from an article on the telephone and phonograph from *The Washington Star*, April 19, 1878:

"My carbon telephone may be used as a heat measurer (thermopile). It will detect the 50,000th part of a degree Fahrenheit, &c."

This paper was mailed to Mr. Preece April 20, 1878, and I prove that he received it by quoting from the same article the following:

"The phonograph will preserve the exact pronunciation. The President of the Philological

Society means to travel with it amongst all the North American tribes."

To set at rest the claims of Hughes on this subject, I quote from a letter received by me a short time since from Professor Langley, the eminent astronomer:

"Allegheny Observatory, June 4, 1878.

"In response to your inquiry, I may state that to the best of my recollection, in October, 1877, at Gow Laboratory, Menlo Park, on my telling you that an instrument more sensitive to radiant heat than the bismuth-antimony-linear pile was desired by me for certain researches in the spectrum, you suggested the use of carbon, of which you were showing Professor Barker and myself specimens. As well as I remember the idea you gave me was that the common small thermopile was capable of developing little energy, the variation of resistance of the carbon under the influence of pressure or traction from a small heated adjacent body might be made to control the energy of a battery of any size, and thus multiply the sensitiveness of the pile almost without limit."

Mr. Preece, in his card, says:

"His (Hughes's) microphone is quite a different instrument to Edison's telephone."

Hughes, in his original paper of May 8, 1878, after summing up the labours of others, says:

"It will be seen, however, that in the experiments made by myself the diaphragm has been altogether discarded, resting as it does upon the changes produced by molecular action, and that the variations in the strengths of the current flowing are produced simply and solely by the direct effect of its sonorous vibrations."

I quote from the *Journal of the Telegraph*, April 16, 1878 (to which paper Mr. Preece is a subscriber) an article taken from the proof-sheets of Mr. Prescott's book on the telephone and phonograph, which reads as follows:

"In the latest form of transmitter which Mr. Edison has introduced the vibrating diaphragm is done away with altogether."

From this book which is now published, I quote from page 226:

"I (Edison) discovered that my principle, unlike all other devices for the transmission of speech, did not require any vibration of the diaphragm. That, in fact, sound waves could be transformed into electrical pulsations without the movement of any intervening mechanism."

This statement by myself for publication in Mr. Prescott's book was written over four months ago.

I quote from a letter from Preece to myself, date London, May 23rd, 1878:

"Hughes's doings border very closely upon yours, and it is difficult to distinguish between what you have done and what he has done."

Again, Mr. Hughes, after describing a number of experiments, sums up and says: "Carbon is used in preference to any other material. . . . It is quite evident that these effects are due to a difference of pressure at the different points of contact."

I quote from the *Journal of the Telegraph*, April 16, 1878:

"By constant experimenting, Mr. Edison at length made the discovery, that when properly prepared, carbon possessed the remarkable property of changing its resistance with pressure, and that the ratios of these changes, moreover corresponded exactly with the pressure."

The same discovery was published in the *Scientific American* of July 17, 1877, *Harper's Magazine*, and many other papers, both in this and other countries. I quote an extract from a letter addressed to Sir H. Thompson, the eminent surgeon, a copy of which was kindly sent me by the writer:

"Hotel Chatham, Paris, June 7, 1878.

"My dear Sir Henry,— . . . . It is certain that at the meeting of the British Association at Plymouth last September, a method of magnifying sound in an electric telephone was described as having been invented by Edison, which was identical in principle and in some details with that brought forward by Hughes.

(Signed) "WM. THOMSON."

Finally, Mr. Preece had ample knowledge, through my correspondence with him, of all I have been doing since he left America, and had my telephone in his possession at least a month before the alleged discovery by Hughes, and it is almost impossible to attribute his failure to defend me (as he was bound to do) against the piracy of Hughes, to his not understanding so simple an instrument, and the principle involved therein.

Mr. Preece says in his card of yesterday:

"I am in no way whatever a coadjutor of Hughes."

I quote from Hughes's original paper announcing his alleged discovery:

"My warmest thanks are due to Mr. W. H. Preece, electrician of the Post Office, for his appreciation of the importance of the facts I have stated, and for his kind council indeed in the preparation of this paper."

Enclosing this letter, allow me to mention that Mr. Hughes has addressed a communication to the French Academy of Sciences, in which he adds to his pirated telephone the induction coil which I have always used in combination therewith, and which alone makes it a practical instrument, thinking perhaps that under cover of foreign language, and before a society whose proceedings are not generally known in this country, he would gain for himself the credit of this combination. He makes no mention of this all-important factor in England, where it would be at once known, and in which country it has been patented nearly a year.

Yours truly,

THOMAS A. EDISON.

Menlo Park, N.J., June 26, 1878.

We have little desire to harp upon this most regrettable affair, but the above communication provokes a few remarks. To any person unacquainted with the true nature and phenomena of the two inventions, the carbon telephone and the microphone, Mr. Edison's proofs are perhaps fair and seeming, and we have no doubt that they will satisfy many readers of the daily newspaper in which they appear; but they are altogether too unsub-

stantial and superficial to weigh with scientific men. Mr. Edison presents his proofs as if the microphone were identical with the carbon telephone, whereas they are distinct instruments. The same general principle may underlie their action, but the principle appears under a new mode in each, and it is the microphone which has revealed this general principle, not the carbon telephone. But even if this were not so, the fact elicited by this controversy that the discovery of the variability of carbon resistance under pressure was anticipated by M. Clerac—and known to Professor Hughes—some ten years before Mr. Edison applied it, deals a fatal blow to the contention of the latter. The strongest point in Mr. Edison's reply is the extract from a letter of Sir W. Thomson to Sir Henry Thompson; but partial extracts are always unsatisfactory, and cannot be justly considered without their context. The "method of magnifying sound" referred to by Sir William, is, we suspect, our old friend the carbon telephone again, pure and simple; for by employing a sufficiently powerful battery and a suitable receiver, the energy of the voice or other sounds may be *magnified*. It is almost needless to point out, however, that a *magnifier* of sounds is not necessarily a microphone, since an instrument might obviously be constructed which would magnify audible sounds, but be utterly insensitive to inaudible sounds. Mere names and other "clothes" will not serve to cloak this matter. Mr. Edison's proofs lead us to infer either that he does not himself yet fully understand what the microphone really is, or that he wishes the American public, rightly or wrongly, to believe it to be a piracy of his carbon telephone. We much prefer to accept the former inference, and we think we can discover evidence of it in his reply. The importance given to the "thermopile," or "thermoscope," as it would be better named, by a contemporary, has apparently helped to mislead him into the belief that his authorship of the carbon telephone was endangered. It is time, however, that Mr. Edison should correct himself, and after the hot and hasty aspersions which he has launched upon the fair fame of two unoffending gentlemen, it will be to his own credit if he frankly acknowledges his mistake. Mr. Edison has many friends in England who admire his inventive abilites, as well as the independent manner in which he has risen, and who will feel sincere regret if he does not make that amends, and reinstate himself in their estimation.

AN IMPROVED MORSE INSTRUMENT.

THE new Morse receiving instrument of MM. de Sussex and Brasseur, of Brussels, possesses some notable improvements over the older forms. In the ordinary Morse apparatus, as is well-known, the disc or blade, by which the marks are made upon a travelling strip of paper, is carried by a lever, which is fixed to the armature of an electro-magnet, the coils of which are connected to the line wire. The armature is ordinarily held apart from the magnet by a light spring; but when a current from the line wire passes through the coils of the magnet the armature is drawn towards the magnet, and the printing disc or blade is brought against the paper. In the new Morse the light spring is discarded, and in its stead a magnetic arrangement is substituted. This consists in placing on the opposite side of the armature, and near to it the ends of two soft iron cores, similar to the cores of the electro-magnet. The opposite ends of these cores are coupled together by a permanent horse-shoe magnet. This magnet, acting through the soft iron cores, attracts the armature and holds it away from the electro-magnet. The soft iron cores are surrounded by fine wire coils, similar to the coils of the electro-magnet, and the currents from the line wire are sent through all four coils—those above, and those under the armature. When a current passes from the lines through these bobbins the electro-magnet attracts the armature downwards while at the same time the poles of the upper coils are reversed, and repel the armature, which is feebly magnetic, downwards, thus assisting the electro-magnets. The resistance of the bobbins is so arranged as to give the maximum power for a given line.

Figures 1 and 2 represent a side and an end view of the essential parts of this apparatus.

A is the permanent magnet, the power of which can be increased or diminished by sliding across it the soft iron regulator R.

B and B' are the upper and lower bobbins.

G is a frame of copper for supporting the cores of the two upper bobbins and the permanent magnet A.

T is a bar of soft iron supporting the lower pair of bobbins and connecting their cords.

P is the soft iron armature, feebly magnetic, for actuating the printing lever.

a, figure 2, is the south pole of the magnet A.

b, is the north pole of the magnet A.

a^1 is the south pole of the cores of the lower bobbins when a current is passing.

M is a portion of the brass frame of the instrument.

The current from the line O, passes to earth E, through the several wire coils to S, magnetises a^1 and b^1, a^1 becoming a south pole, and b^1 becoming a north pole. At the same time the poles *a*, *b*, of the permanent magnet are reversed, *a* becoming a north pole, and *b* a south pole.

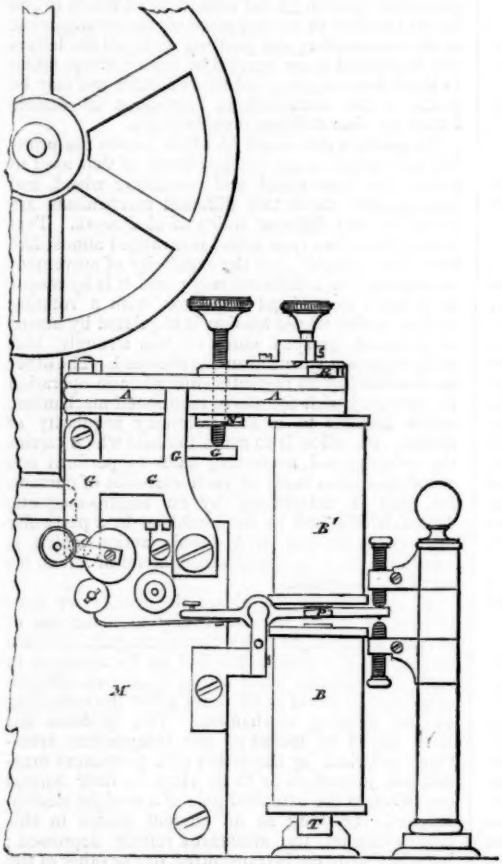
The armature P, which always retains some residual magnetism, remains a north pole at the end *b*, and a south pole at the end *a*; and is, therefore, repelled at the change of polarity in the cores of the coils B^1, B^1, while being simultaneously attracted by the poles a^1 b^1 of the lower bobbins.

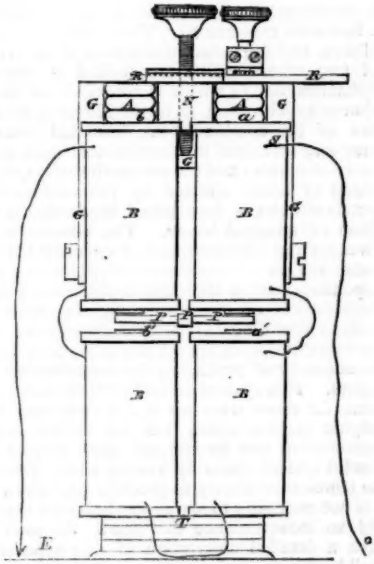
The main advantage of this form of construction is the increased sensitiveness of the armature to line currents; and MM. de Sussex and Brasseur also apply the same principle to relays for long lines. In fact, a Morse of this description is in itself an excellent relay when divorced from the marking parts.

Some idea of the sensitiveness of the instrument may be gathered from the information that correct signalling has been obtained from it by a small Leclanché cell, acting through 1,000 ohms resistance; and twenty-five Leclanché cells, each seven centimetres high, give correct marking through 30,000 ohms. It is also worthy of mention that a bare copper wire, a kilometre long, laid along the

grass of the Jardin Zoologique, Brussels, during a soaking wet day, transmitted enough of the currents from ten small Leclanché cells to work the instrument satisfactorily.

In addition to the unusual sensibility of the apparatus it is especially suitable for duplex working without the aid of condensers, on land lines of from four to five hundred miles. By winding the coils differentially, by the employment of a rheostat or artificial line of three graduated resistances, one for *dry*, another for *fair*, and a third for *foul* weather, and by means of the provision for adjusting the armature, duplex working is rendered successful without condensers.





For some time past this form of Morse instrument has been experimentally tried in duplex working on the Belgian Government telegraph line between Brussels and Liége, a length of 100 kilometres, and, as appears from the report of Mr. John Gibbs, the Chief-Inspector of the Service, it has given entire satisfaction. Two operators were employed at each end of the line, and the results were equivalent to a Hughes' Printer operating in simplex. The battery employed varied from ten to twenty Leclanché elements, according to the state of the weather.

A small portable field Morse of this kind is specially constructed for military purposes. It can be arranged for simplex, duplex, or the automatic recording of messages sent out from the home station. The experiment of the Jardin Zoologique would indicate the serviceableness of the apparatus for campaigns in which the insulation of lines is, as a rule, very defective, and the currents available very weak. A patent for this apparatus, No. 3,639, 1877, has been taken out in England.

THE DARIEN CANAL.—The contract for the cutting of this canal has been ratified and the work will proceed forthwith. It is specified that it be completed by the year 1895, and when open shall be neutral to the whole world. A strip of land, for its entire length, on each side of the canal, and 1,000,000 acres besides have been granted to the company by the government of Columbia.

ELECTRIC TELEGRAPHY AT THE UNIVERSAL EXHIBITION OF 1878.

By M. LE COMTE DU MONCEL.

Continued from page 270.

THE instruments of MM. Baudot and Meyer, which we have described in our preceding articles, have found an imitator in the Austrian Exhibition. M. O. Schaeffer exhibits two extremely interesting instruments, which appear to be happy modifications of the above-named. We have not yet been able to study them sufficiently minutely to discover the exact points of resemblance between them and the French instruments; but the principle is evidently the same, and they are admirably constructed.

In the apparatus called by M. Schaeffer "Multiple Type-writing Telegraph," arranged for four transmissions, the motor system, which gives movement to the four instruments, is fixed in the centre of a large table, and the receivers are double Hughes' instruments. The manipulating keys are the ordinary Hughes' manuals, and the "combiners" are disposed in pairs, like the receivers. A first glance at these instruments shows that the author has made use of both directions of the current, so as to employ a smaller number of electro-magnetic parts; and instead of the 20 electro-magnets which, in M. Baudot's system, would have to be applied to the combiners for four simultaneous transmissions, M. Schaeffer uses but 10. There are, it is true, in addition, the four electro-magnets of the receiver and two others, which are applied to the motor mechanism, one of which is intended for the regulation of synchronism, as in the Meyer system. The discs of the combiners are insulated from each other and arranged in couples near each group of electro-magnets; and the production of impressions, instead of being effected by the combination of electric circuits, is determined mechanically by the action of engaged levers. The combiners themselves act under the influence of a general distributor, whose motion is synchronous with that of its correspondent, as in the Meyer apparatus; and the combinations of elementary signals intended to produce the different letters are effected by the mere depression of the manual keys, thus obviating the necessity of producing the combination by the fingers. This system is undoubtedly more convenient for those who are not accustomed to telegraphic manipulation; but for skilled employés transmission can be effected more rapidly by the Baudot system, since by having under the fingers the contacts necessary to produce any given signal, it is not necessary to search for them on a key-board, and so inconvenience the hand. As soon as we have a detailed description of this apparatus, we shall hasten to present it to our readers, as it seems to us to merit their attention equally with M. Baudot's, although it is but a derivation from the latter.

The instruments of MM. Baudot and Schaeffer naturally lead us to consider the other printing systems represented in the Exhibition, and among them we discern that of M. Olsen, which appears to us to be the most important after M. Hughes', which has always maintained the lead hitherto, and of which several specimens appear in the Exhibition.

PRINTING TELEGRAPH OF M. OLSEN.—Of all the improvements sought to be imported into the printing telegraph of M. Hughes, none have been so successfully combined as those which we see united in the printing telegraph of M. Olsen; not only can this apparatus transmit automatically, but it allows, by its mere arrangements of parts, a more rapid despatch of messages. The mechanical and electrical arrangements are, furthermore, quite distinct from M. Hughes', so that it may be regarded as quite an original invention. This instrument has been submitted to several months' test by the French Telegraph Administration, and has given much satisfaction; its performance under ordinary manipulation may be estimated at 14 per cent. superior to that of the Hughes, and, with the automatic system, 33 per cent., a result which is due to the fact that in consequence of the arrangement of the transmitting and printing parts, all the letters can be printed in an interval of time corresponding to three letter spaces, and that effective use may be made of the simultaneous depression of double letters for nine different combinations.

To produce this result M. Olsen causes the printing mechanism to act independently of that used to rotate the type-wheel and correcting wheel, and consequently these two different mechanisms are driven by two different trains of clockwork. That which drives the type-wheel is arranged almost like that of the Hughes, but the regularity of movement is obtained in a different way; and it is by means of a small centrifugal regulator, with a rotating friction brake, whose tension is regulated by means of a barrel, grasped more or less strongly, that uniformity and syncronism are obtained. The other mechanism has no regulator, but when in operation is connected with the above mentioned mechanism, which imparts to it the necessary regularity of action. Its office is to cause the axis which carries the printing and correcting cams to perform one revolution upon itself at each emission of current. Its play is determined by an electro-magnetic detent, which had to be combined in a particular manner by reason of a double action which is exerted upon it by the electro-magnet of which we are about to speak.

In this system, to obtain the results we have alluded to, it has been necessary to make use of reverse currents, and the electro-magnet intended to operate the detent has had to be arranged in such manner, that while acting upon two different armatures, it could at all times effect the unlocking of the printing mechanism. This problem has been solved by means of two independent armatures, polarised by the action of a permanent magnet, and jointed so as to lie close, in their normal condition, to the extended pole of a straight electro-magnet. So long as no current passes in this electro-magnet, the armatures remain depressed; but when a current is transmitted, one or other of the armatures rises according to the direction of the current; and as over the armatures are two arms, acting as an anchor escapement to a shaft, which re-acts upon the detent, the latter releases the printing mechanism at each movement performed by the armatures. We shall now see how the armatures thus raised act upon the printing cam, and enable it to produce the impressions.

We know that in the ordinary Hughes' system, the correcting wheel possesses as many teeth as there are letters on the circumference of the type-

wheel, so that to obtain two successive letter impressions, it is necessary for the printing shaft to make at least one whole revolution. Now, for this revolution, is needed a time equal to that occupied by the contact maker of the transmitter in passing over four contacts. M. Olsen, thinking this time much to great, has sought to reduce it by one-half, by allowing two impressions to be recorded by the printing shaft instead of one; and to this end he has applied two printing cams to the shaft; but that these cams might act independently when required, by the position of the successive letters transmitted, he found it necessary to arrange the printing lever, upon which they impinge, so as to be capable of lateral displacement; and he also had to separate them one from the other, by a space equal to one-fifteenth of the periphery of the type-wheel. On the other hand, as in so short an interval the correcting cam could not exert its function upon a correcting wheel disposed in the ordinary way, M. Olsen has reduced, by one-half, the number of teeth upon the latter, so that an interval between two teeth instead of corresponding to one letter, as in the Hughes' System, corresponds to two letters, and the interval between the two cams on the printing shaft exactly corresponds to that between the teeth. To enable either of the cams to be brought into action at will, according to the letter to be printed, M. Olsen binds the fork of the printing lever by a small bridle fitted to the detent shaft of the printing mechanism, the fork itself being centred; and accordingly as the detent shaft turns to the right or left, that is to say, according to the direction of the current transmitted, it presents the tip of the fork to one or other of the cams, which then acts as in the ordinary Hughes. At the same time that this action is taking place, a level-wheel gearing turns a vertical shaft which carries the correcting cam, which is in form of a helix, and which effects the re-adjustment. It is this vertical shaft, furnished at its upper portion with a toothed sector very finely gearing into a wheel of the first clock-work, which connects the two motor mechanisms during the time of impression and correction. In order that the line may present equal charges of positive and negative, a small friction commutator is put in action by the two electro-magnet armatures, and sends into the line after the apparatus is set in action, currents which are contrary to those transmitted, and which are of longer or shorter duration accordingly as the signalling currents are in one or the other direction.

The transmitter, instead of being circular, as in the Hughes system, is longitudinal, and is placed underneath the apparatus, immediately behind the finger-keys. It is, in fact, a horizontal arbor, furnished with cams arranged so as to form a helix, and separated by spaces precisely corresponding to the spaces between the letters on the type-wheel; it is also driven by the same clock-work which drives the type-wheel; and the passage of the cams against contact pieces thrown out by the keys, furnishes at the required times the closing of the circuit necessary to the transmission of signals. As the currents sent out require to vary in direction for each successive letter, the electrical connection between the interruptors and the line is made in a reverse manner for each key, and in order that these combinations may adapt themselves to both sending and receiving, they are made to originate in a reversing commutator which is fixed on the back plate of the instrument and works automatically.

This disposition of the commutator is really very ingenious, for its movements are controlled without any effort on the part of the employé, and by the very operations which he is obliged to perform to set his instrument for sending or receiving. In fact, when sending he has to press down the "blank" pedal, and from the depression of this pedal results a movement of the commutator which places it in position for transmitting. On the other hand, to receive he has to press down the "blank" letter key, and from this alone the commutator changes its position.

All the other functions of the apparatus are performed as in the ordinary Hughes. Thus the change from letters to figures is produced by a special key placed on the key-board, as in the latter instrument; the zero or "blank" pedal acts in the same manner; and the unlocking of the motor apparatus is effected by means of a brake placed above it. The weights are tackled, also like the Hughes, and are wound up by a pedal and ratchet-wheel, but they are much less heavy. The apparatus is further provided with special contacts for duplex working.

As regards the mechanism for automatic transmission, it is very simple; it somewhat resembles the first Wheatstone automatic Morse system. The slip is perforated by means of a keyed perforator, similar to the transmitter; and the holes are ranged along two different lines, and are spaced in accordance with the distance between the letters of the type-wheel. The slip is drawn through a strong mill, put in motion by the same mechanism which turns the type-wheel, and the length of slip which runs through is calculated so that the length occupied by the different letters of the alphabet is unfolded in the time occupied by the type-wheel in performing one revolution. Two small bent points rest on the slip, and being supported by a double-jointed arrangement, are susceptible of two motions —1st, one which allows them to pass through the perforations; 2nd, a very slight longitudinal movement in the direction of the paper, which is made to control a circuit breaker. One of these points sends positive currents and the other negative, so that if the perforator has punched the holes in such manner that those on the left of the slip correspond to letters requiring negative currents, and those on the right to the other letters, transmission will be performed in an extremely simple manner; the complicated combination is entirely left to the perforator, which, being purely mechanical, can adapt itself without the employé having to do anything but press down the keys. With M. Olsen's apparatus this operation is performed as easily as the transmission of a message by the ordinary Hughes.

As we have said, besides the transmission of single letters, which can all be done with a spacing of three letter-intervals, it is possible to effect nine simultaneous transmissions of double letters, viz., blank and C, B and E, F and I, D and G, H and K, L and O, P and S, figure-blank and T, figure-blank and V, Z and A.

In spite of its delicate and complicated parts, this apparatus has been found to work well, and has been the admiration of all who have seen it working automatically in the Exhibition.

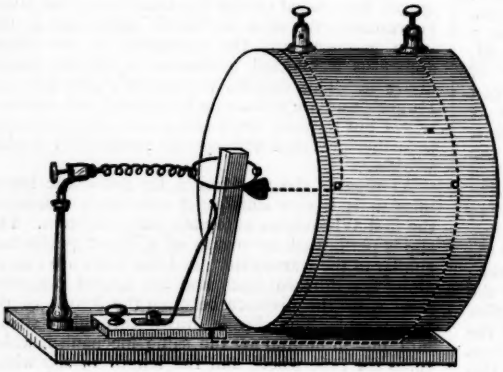
NEW MICROPHONES.

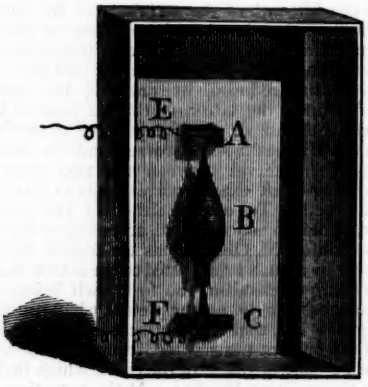
To the Editor of THE TELEGRAPHIC JOURNAL.

SIR,—I have for some time thought that the true basis for a microphone for speaking was a tympanum-covered box, similar to those joined by a thread, and used as the so-called "Toy Telephone." These instruments speak clearly and audibly—the vibration of one tympanum vibrating the other at the opposite end of the string, and reproducing the sounds which influenced it. I therefore argued, that if all conditions were equalized, and a Hughes's Microphone, or carbon "wave-producing" arrangement, were placed in connection with the surface of the parchment tympanum, it should communicate as clearly through a distant Bell Telephone, and at the same time proportionately louder.

This I have found to be so, and have designed a form of microphone—quite novel, I believe—of which I send you a sketch. It gives results that will, I think, amply repay the extra trouble of its manufacture, reproducing in a distant Bell Telephone *every word* PERFECTLY UNMISTAKABLE, and CONSIDERABLY louder than originally spoken to it.

The above sketch needs little description. On the centre of the outer surface of the tympanum is fastened (with gum) a small triangular bit of "pencil graphite," having a fine wire attached to the circuit. Immediately above this a small ring is fastened through the tympanum to a very small shield at the back, and to the ring is attached a small spiral spring, or better, a fine india-rubber band, with screw adjustment (as shown), in order to obtain the forward tension on the tympanum (as produced by the "sag" of the thread in the "Toy Telephone"). The upright carbon—which is of the ordinary gas graphite, cut to a knife edge on the inside—is hinged to a slide below, which gives a power of adjusting it, and is kept pressed slightly against the pencil graphite edge by a very light steel spring, which (as shown) is also adjustable. This is of course designed solely for speaking, in which a considerable stability, combined with great elasticity, both in tension and pressure, are required. For very delicate experiments I have designed a form (of which I also send you a sketch, should you think it worth inserting), in which both friction and contact are reduced to an absolute minimum. This, when vertical and nicely balanced, is *wonderfully* sensitive—not only the noise of the fly *walking*, but that of his touching a pane of glass with his tongue, or sucking a grain of sugar—is DISTINCTLY *audible* in the telephone.





Yours, &c.,

A. M. VEREKER.

In the figure representing microphone for delicate experiments, A, is the upper support of gas graphite; B, peg-top shaped vibrator of same; C, wooden block through which D slides for adjustment; D, a pencil graphite point on which B rests; E, F, wires to battery and telephone. Both drawings are made half full size.

A PERMANENT photographic portrait of Dr. WERNER SIEMENS is in preparation for this Journal, and will be issued, with biographical sketch, with the Number of August 15th.

THE same and following issues will also contain a specially written notice of the British Association Meeting at Dublin.

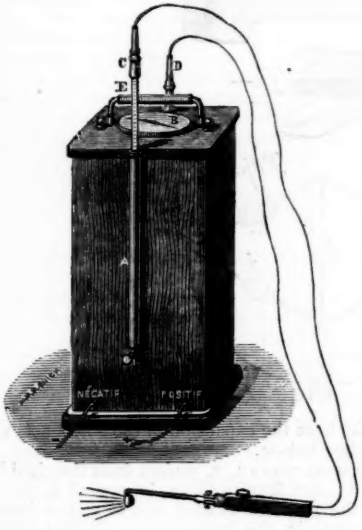
IT is rumoured that an invention or discovery more wonderful than any of those which have of late astonished the scientific world is about to be brought before the public.

THE POLYSCOPE.

M. TROUVÉ has recently presented to the *Societé de Physique* a new apparatus, named the Polyscope, designed to illuminate the cavities of the human body, the interior of mines, powder mills and magazines, the depths of the sea, &c. This apparatus is based upon the property which a voltaic current possesses of disengaging heat in a circuit of small section, and of which Dr. Joule, of Manchester, has given the following law :—

The quantity of heat disengaged in unit time in a homogeneous metal wire traversed by a voltaic current is proportional 1*st to the resistance that the wire opposes to the passage of the electricity, and,* 2*nd, to the square of the intensity of the currents.*

This property of the voltaic current of white-heating metallic conductors in traversing them, has been utilised in chirurgery by John Marschall about 1851, by Leroy d'Etioles in 1853, Mideldorpf in 1854, and Broca in 1856, &c. It was only at a later



time that lighting was aimed at. In 1867, Doctor Bruck, a dentist at Breslau, presented an apparatus designed to light the buccal (cheek) cavities, to which he gave the name of Stomatoscope. A little later in France, Doctor Millot made numerous experiments for to light the stomachs of animals at the Ecole Pratique, Paris. Success did not crown these attempts because of the inconstancy of the electric source which consisted of Grove and Bunsen cells, and required then to have very thick platinum wires to avoid exposing them to a permanent volatilization. Good luminous effects were obtained, but they were accompanied by heating effects too intense for the practical application of the method. Recourse was had to a circulation of water to annihilate the heat in proportion to its production, but the apparatus then became too voluminous and difficult of management for practical use. M. Trouvé, convinced of the practical importance of such a system of lighting, has devoted himself constantly to the subject since 1870. These researches have been completely successful, and the success is due, as he himself has admitted, to his judicious selection of the secondary battery of M. Gaston Planté.

The apparatus of M. Trouvé is composed of a reservoir A, or electric store, consisting of a Planté secondary battery, with an arrangement for regulating at will the flow of the current from it, by means of a special rheostat A, C, of great simplicity, and by the addition of a galvanometer B, with two circuits, in which the electromotive force of the reservoir, and that of the Trouvé-Callaud battery, intended to charge it, are opposed. Thanks to the ingenious combination of these instruments, the practitioner can always regulate at will the flow of the current, and know always by the galvanometer the state of the charge in the secondary battery. We have used the word flow, for those of our readers who are familiar with the secondary battery, know that it can be completely assimilated to a hydrostatic reservoir. The rheostat on the secondary battery, plays the same part as the hydrostatic reservoir; both moderate at will the flow of the current from the reservoir. This regularity is so great, that the apparatus of M. Trouvé, permits of raising to the point of fusion, without going beyond it during several consecutive hours, fine platinum wires of from $\frac{1}{15}$ of a millimetre, to 1½ millimetres in diameter. The constancy of the electromotive force of the secondary battery, and the adjustable rheostat renders it possible to accurately determine once for all the point of fusion of wires of given thickness. Instead of employing a small spiral of the platinum wire as a wick, M. Trouvé ingeniously flattens the wire in the middle so as to obtain a little glowing disc for his illuminator. The substitution of this disc for the ordinary platinum spiral gives a lighting power sensibly doubled, as proved by Captain Manceron, in his experiments on lighting the interior of cannons at Saint Thomas d'Aquin. That distinguished officer has been able, with the polyscope, not only to light up the interior of cannons and shells, but also to obtain projections of them. In this way he shows upon a screen the smallest defect in pieces of artillery.

The lower part of the figure is the small reflector, spherical-concave or parabolic. It may be furnished with a diminutive folding mirror on its upper edge to direct the beam of light from the platinum disc, as may be desired. It is fitted with a handle, and wires connecting it to the reservoir. Instead of the reflector shown, a variety of cauteries, either pointed or knife-edged, may be inserted into this handle, and reflectors for special purposes, such as that used by dentists for inserting into the mouth to examine the gums.—*La Nature.*

In connexion with this subject we may mention that Mr. Edison proposes to enclose a tiny electric light in a glass bolus, small enough to be swallowed, for the purpose of illuminating the stomach, and exhibiting the process of digestion.

EDISON'S MICRO-TASIMETER.*

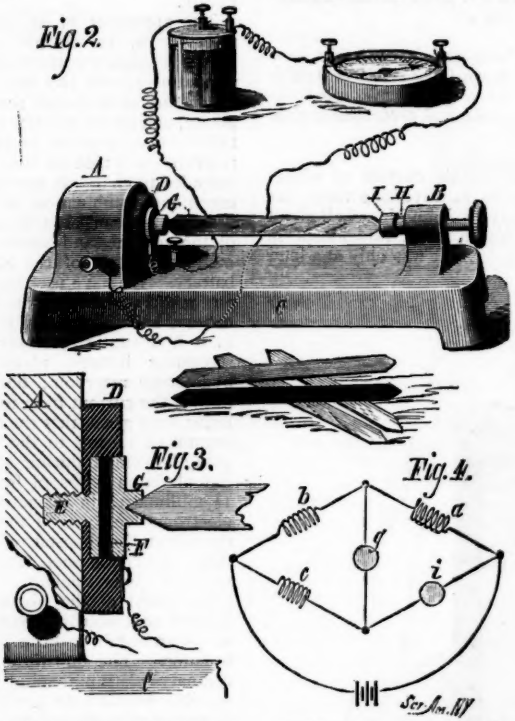
THE latest of Edison's inventions, and perhaps the most interesting to physicists, is his micro-tasimeter, or measurer of infinitesimal pressure.

The thermopile, hitherto foremost among delicate indicators of changes of temperature, must now be consigned to the rear ranks, and the radiometer, which exhibits the motive power of the most subtile of forces, must retire in favour of an instrument that can weigh that force.

The micro-tasimeter is the outcome of Professor Edison's experiments with his carbon telephone. Having experimented with diaphragms of various thicknesses, he ascertained that the best results were secured by using the thicker diaphragms. At this stage he experienced a new difficulty. So sensitive was the carbon button to the changes of condition, that the expansion of the rubber telephone handle rendered the instrument inarticulate, and finally inoperative. Iron handles were substituted with a similar result, but with the additional feature of musical and creaky tones distinctly audible in the receiving instrument. These sounds Professor Edison attributes to the movement of the molecules of iron among themselves during expansion. He calls them "molecular music." To avoid these disturbances in the telephone, the handle was dispensed with; but it had done a great service in revealing the extreme sensitiveness of the carbon button, and this discovery opened the way for the invention of this new and wonderful instrument.

The micro-tasimeter is represented in perspective in fig. 2, in section in fig. 3, and the plan upon which it is arranged in the electric circuit is shown in fig. 4.

The instrument consists essentially in a rigid iron frame for holding the carbon button, which is placed between two platinum surfaces, one of which is fixed and the other moveable, and in a device for holding the object to be tested, so that the pressure resulting from the expansion of the object acts upon the carbon button.



Two stout posts A, B, project from the rigid base piece, C. A vulcanite disc D, is secured to the post A, by the platinum-headed screw E, the head of which rests in the bottom of a shallow circular cavity in the centre of the disc. In this cavity, and in contact with the head of the screw E, the carbon button F, is placed. Upon the outer face of the button there is a disc of platinum foil, which is in electrical communication with the battery. A metallic cup G, is placed in contact with the platinum disc to receive one end of the strip of whatever material is employed to operate the instrument.

The post B, is about four inches from the post A, and contains a screw-acted follower H, that carries a cup I, between which and the cup G, is placed a strip of any substance whose expansibility it is desired to exhibit. The post A, is in electrical communication with a galvanometer, and the galvanometer is connected with the battery. The

* We are indebted to Mr. Edison for the blocks wherewith to illustrate this article.

strip of the substance to be tested is put under a small initial pressure, which deflects the galvanometer needle a few degrees from the needle point. When the needle comes to rest, its position is noted. The slightest subsequent expansion or contraction of the strip will be indicated by the movement of the galvanometer needle. A thin strip of hard rubber, placed in the instrument, exhibits extreme sensitiveness, being expanded by heat from the hand, so as to move through several degrees the needle of a very ordinary galvanometer, which is not affected in the slightest degree by a thermopile facing and near a red hot iron. The hand, in this experiment, is held a few inches from the rubber strip. A strip of mica is sensibly affected by the heat of the hand, and a strip of gelatin, placed in the instrument, is instantly expanded by moisture from a dampened piece of paper held two or three inches away.

For these experiments the instrument is arranged as in fig 2, but for more delicate operations it is connected with a Thomson's reflecting galvanometer, and the current is regulated by a Wheatstone's bridge and a rheostat, so that the resistance on both sides of the galvanometer is equal, and the light-pencil from the reflector falls on 0° of the scale. The principle of this arrangement is illustrated by the diagram, fig. 4. Here the galvanometer is at *g*, and the instrument which is at *i* is adjusted, say, for example, to ten ohms resistance. At *a*, *b*, and *c*, the resistance is the same. An increase or diminution of the pressure on the carbon button by an infinitesimal expansion or contraction of the substance under test is indicated on the scale of the galvanometer.

The carbon button may be compared to a valve, for, when it is compressed in the slightest degree, its electrical conductivity is increased, and when it is allowed to expand it partly loses its conducting power.

The heat from the hand, held 6 or 8 inches from a strip of vulcanite placed in the instrument—when arranged as last described—is sufficient to deflect the galvanometer mirror so as to throw the light-beam completely off the scale. A cold body placed near the vulcanite strip will carry the light-beam in the opposite direction.

Pressure that is inappreciable and undiscoverable by other means is distinctly indicated by this instrument.

Professor Edison proposes to make application of the principle of this instrument to numberless purposes, among which are delicate thermometers, barometers, and hygrometers. He expects to indicate the heat of the stars, and to weigh the light of the sun.—*Scientific American*, June 22.

SOME ELECTRICAL EXPERIMENTS WITH CRYSTALLINE SELENIUM.

By ROBERT SABINE.

THE experiments were undertaken with a view of removing, if possible, some of the difficulties which had been found in the way of constructing constant resistances of crystalline selenium.

The experiments were made with several specimens of annealed selenium, some of which were provided, when in the amorphous state, with platinum wires. The selenium was made in the form of plates about 0·1 centim. thick, 0·5 to 1 centim. broad, and 2 to 3 centims. long, wires (when employed) being inserted transversely at equal distances apart. In some specimens, the wires were laid upon a small piece of mica or platinum-foil, and the melted selenium dropped upon them; in others the platinum wires were heated to incandescence in a smokeless flame, and, while still hot, were imbedded in the amorphous selenium. The two methods appeared to be capable of giving equally firm contact, which was probably due chiefly to the contraction of the selenium round the platinum wire.

In preparing the selenium plates, care was taken to obtain as good a surface as possible, by melting the amorphous selenium between edge strips of glass upon a piece of bright platinum foil, upon which it was annealed.

The resistance of the junctions between the selenium and the platinum wires imbedded in it was found to be very various, but not to depend upon the manner in which the wires were imbedded in the selenium previous to its being crystallized. It was also found that the conducting-power of the selenium differed materially in different parts of the same plate.

A plate of selenium annealed at 170° C. was provided with four platinum wires, imbedded in it at different points, 0·5 centim. apart. The resistances were measured with + and — currents, and the means assumed to be sufficiently near for the purpose.

Between wires.	Measured resistances.
1 and 2	31 megohms.
2 „ 3	162 „
3 „ 4	11 „
1 „ 3	174 „
2 „ 4	172 „

From these measurements, by the well known formula, the separate calculated resistances are:—

Junction number.	Resistance of junction.	Resistance of selenium between junctions.
2 . . .	9·5 megohms	152 meghoms.
3 . . .	0·5 megohm	

This is an instance of high selenium resistance in the middle and low resistance towards the ends in an otherwise apparently homogeneous plate, and of low junction resistances. The two junctions were made at the same time, in the same manner, by melting the selenium upon the wires; and yet one of them has nearly twenty times the resistance of the other.

A second plate of selenium, provided with six platinum wires and annealed at 150° C., was measured with + and — currents in the same way, mean values being taken. This gave the following results:—

Junction number.	Resistance of junction.	Resistance of selenim between junctions.
2 . . .	429 megohms	22 megohms.
3 . . .	479 „	13 „
4 . . .	498 „	0 „
5 . . .	428 „	

In this plate, therefore, nearly all the resistance

was situated in the junctions, whilst the selenium offered a comparatively small resistance, its conducting-power being much greater at one end than at the other.

A third plate was provided with seven platinum wires 0·7 centim. apart, annealed at 205° C. It showed electrically more homogeneity of material and quality of junction resistances.

Junction number.	Resistance of junction.	Resistance of selenium between junctions.
2 . .	·0333 meghom	0·1914 megohm
3 . .	·0553 „	0·1045 „
4 . .	·0328 „	0·1233 „
5 . .	·0199 „	0·1084 „
6 . .	·0285 „	

It is clear from these measurements that a large portion of the observed resistance of a so-called selenium resistance may, and frequently does, reside in the junctions and not in the selenium. Therefore the larger we make the service of contact between the platinum and the selenium, the less likely are we to find an otherwise sensitive piece of selenium rendered comparatively insensitive by the introduction of high junction resistance. In this respect the form of selenium plate designed by Dr. Werner Siemens, in which the platinum wires form gratings or interlying spirals, is unquestionably the best form to employ when the object in view is to obtain a high sensitiveness to light.

The author next describes some experiments by which he shows that the resistances of junctions and selenium are both affected by variations of *temperature* in nearly an equal ratio.

Resistance of Selenium altered by the inversion of the Current.

The fact that the current strength in the circuit of a bar of selenium and a battery is subject to change when the direction of the current is reversed has been pointed out by Professor Adams and Mr. Day. The inquiry naturally occurs whether the seat of the change is in the selenium or at the junctions. To determine this, it is only necessary to ascertain the resistance of the junctions and of the selenium separately with two different battery powers to find which agrees best in the two measurements.

A plate of selenium, with four wires, *a*, *b*, *c*, and *d*, imbedded in it, was inserted in a Wheatstone bridge with an intervening commutator, so that the selenium could be inverted whilst the other members of the bridge remain unaltered. The side of the bridge containing the selenium was also furnished with a reflecting galvanometer of comparatively low resistance, by means of which the current moving in that side could, within a very small percentage of error, be observed. The battery-circuit was provided with a sliding resistance, by means of which, whichever section of the selenium plate was in circuit, the current in it, as indicated by the galvanometer, could be kept at a constant value. In this way the following measurements were made:—In the first series the current strength in the selenium was kept uniformly at 2·9 microwebers, and in the second at 0·42 microweber. The positions of the selenium are indicated as "direct" and "inverted."

Resistance measured between	Current = 2·9 microw.		Current = 0·42 microw.	
	Direct. meg.	Inverted. meg.	Direct. meg.	Inverted. meg.
a and *b*	·3176	·3181	·3202	·3244
b „ *c*	·3864	·3858	·3936	·3893
c „ *d*	·2734	·2734	·2747	·2782
a „ *c*	·6095	·6097	·6116	·6116
b „ *d*	·4842	·4846	·4906	·4900

Call the resistance of the selenium between *b* and *c* $\left\{\begin{matrix} s \\ s' \end{matrix}\right\}$ when the current is $\left\{\begin{matrix} \text{direct} \\ \text{inverted} \end{matrix}\right\}$; the resistance of the junctions $\left\{\begin{matrix} b \text{ and } c \\ b' \text{ and } c' \end{matrix}\right\}$ when the current is $\left\{\begin{matrix} \text{direct} \\ \text{inverted} \end{matrix}\right\}$; the resistance from *a* up to *b* $\left\{\begin{matrix} a \text{ ..... direct} \\ a' \text{ ..... inverted} \end{matrix}\right\}$; and, lastly, the resistance from the junction *c* to the end *d* $\left\{\begin{matrix} d \text{ .....direct} \\ d' \text{ .....inverted} \end{matrix}\right\}$.

It is evident that by measuring the resistance between each of the wires *a*, *b*, *c*, and *d*, in turn, with two different current strengths, we have data which enable us to calculate the mean resistances of the junctions as well as that of the selenium. If, with the two different current strengths, the calculated values of the junctions agree, we may assume that the change resides in the selenium; on the other hand, if the selenium agrees in both calculations the change must reside in the junctions.

The above tests furnish the following results:—

Resistance of	Measured.	Current = 2·9 microw.	Current = 0·42 microw.
		meg.	meg.
b + *b'*	direct	·0945	·1022
	inverted	·0942	·1021
c + *c'*	direct	·1756	·1777
	inverted	·1746	·1775
s + *s'*	.....	·5028	·5032

The agreement is in favour of the selenium, the mean resistance of which does not appear to change by decreasing the current strength: the mean resistances of the junctions, however, increased, one of them considerably; and it is therefore probable that in them, and not in the selenium, lies the change in question.

(To be continued.)

Notes.

THE TELEPHONE.—Professor Dolbear has recently shown how nearly Reiss came to inventing a true speaking telephone. A drop of water inserted between the diaphragm and spring make and break contacts of Reiss' 1861 telephone, transforms it into a speaking telephone similar to Elisha Gray's. Professor Dolbear constructs a serviceable "water telephone" without the use of electro-magnetism, by using two parallel metal diaphragms fixed to a wooden ring, and forming a shallow box. The interior of this box, or space between the diaphragms, is filled with water. A battery is connected up to one diaphragm, and the other is

connected to line, so that the current passes through the water, the sound waves impinging on one diaphragm oscillate the resistance of the water, and a vibratory current is transmitted. If the speaking diaphragm be of iron, and the other of zinc, a feeble current is generated in the telephone itself. This telephone only acts as a transmitter as at present constructed.

M. SCHNEEBELI is engaged in causing a telephone, uttering a continuous note, to illustrate the formation of the vowels and consonants by varying the vent in front of the diaphragm. A tuning-fork is caused to interrupt the primary wire of an induction coil, while the secondary is in circuit with a telephone. By this means a loud note is obtained from the telephone. If then the mouth of the telephone be closed by the hand the vowels *u o* and *a* are easily imitated by varying the opening between the forefinger and thumb. The consonants may also be imitated. For instance, *b* is fairly reproduced by smacking the palm of the hand against the orifice of the telephone.

IT is reported that Mr. Edison has so far perfected his carbon telephone, that words spoken 100 feet from the transmitting telephone could be distinctly heard in the receiver, the length of the line in this case being only 30 rods.

THE Bell telephone was employed at the Wimbledon Camp, under the direction of Mr. T. Fletcher, electrician to the Telephone Company, in communicating between the marksmen and targets.

THE MICROPHONE.—M. Michel-Etienne de Rossi, of Rome, writes to *La Nature*, suggesting the application of the microphone as a means of detecting the subterranean rumbling sound, or *rombo*, which always accompanies and often precedes an earthquake, thus serving as a forewarner of the shock. A special microphone might also be employed as a micro-seismograph. *Apropos* of this subject, it has occurred to us that the microphone might be advantageously employed in observations on the quiesence of volcanoes. Cannot Professor Palmieri find a use for it at Vesuvius? Microphones properly placed in the crater and connected to a telephone would advertise a disturbance to any distance.

M. GAIFFE, constructs a special microphone by abutting a horizontal cylinder of carbon against the side of an upright plate of carbon so that about half of the thickness of the cylinder is in contact with the top of the plate. The cylinder is supported on a vertical stem on which it can slide up or down so as to adjust the contact.

THE PHONOGRAPH.—Mr. W. H. Preece has received an interesting communication from Dr. Clarence Blake, of Boston, on the diaphragm of the phonograph. It has been suggested in England that a phonograph diaphragm, shaped like the drum membrane of the human ear, might give improved phonographic utterance. Dr. Blake was led to the same conclusion from finding that flat discs gave too great a prominence to certain heavier overtones of the voice, to which they respond, and hence falsified the *timbre* of the voice in reproducing it. By forming the phonograph diaphragm into a flat trumpet-shape (with a funnel section), and fixing the embossing style into the cusp, it was found that the lighter over-tones were faithfully reproduced by it, while the sharper exaggerated over-tones recorded by the flat disc were cut off. When the embossing, as well as the reproducing, was done by this curved membrane, the sharper over-tones disappeared, and the quality of the voice was much more natural. Moreover, there was a gain in sensitiveness; the embossing could be done at a distance of 15 feet from the speaker, and clearly reproduced. The material of these membranes may be either stout felted paper, varnished on its outer surface, or drum-vellum, moistened and modelled into shape before using. "The principle governing the vibrations of such a disc," says Dr. Blake, "is that of imparting the vibrations to the centre of a membrane, the curve of which enables it to reproduce a large range of over-tones, its tension serving as a counter-balance to the central pressure." Dr. Blake has also found that the groove in the phonograph cylinder when covered with tinfoil, became a resonator for the high scratching noise of the embossing point and materially interfered with the reproduction of the quality of the voice. By stretching a thin layer of rubber-tissue over the cylinder this resonating effect was abolished, and the scratching noise materially lessened.

IN France and Germany it is proposed to make the "phonograph" a feminine noun, because of its propensity for talking back.

THE French Jury were uncertain whether to consign the phonograph to Class 15, Instruments of Precision, or Class 65, Telegraphic Instruments, in the Paris Exhibition, but they finally relegated it to the latter, on the consideration that it can serve as a recorder of telephone messages.

A PHONOGRAPH message was recently sent by Edison's telephone from the Paris Exhibition to Versailles, in presence of several *savants*.

JULES JAMIN ON THE ELECTRIC LIGHT.—We make the following notes from M. Jamin's recent discourse on lighting by electricity:

The brilliancy of the electric arc is equal, if not superior, to that of the sun—the latter being a star already old, and partially cooled.

Opalescent glass globes, by diffusing the light, reduce

its lustre to a degree proportionate to their surface, but waste a little light by absorption.

When alternative currents succeed each other at intervals of one-twenty-fifth of a second, the effect is that of a continuous light.

Jablochkoff, by introducing his condensers in circuit, is enabled to double the number of lamps fed from the same machine, the light of each lamp being, however, reduced one-half, *i.e.*, to 25 carcel burners. Flames of oil and gas are rich in the less refrangible colours, red and yellow, but poor in the more refrangible colours, blue and violet. It is impossible to supply the latter, hence the inferiority of such lights for illumination. The light from the glowing carbon points in the electric arc is white like sunlight, and has a similar spectrum: that from the arc itself, however, is rich in the more refrangible rays, hence its bluish tinge. This defect can be removed artificially, however, for sulphate of quinine or uranium glass transform the more refrangible rays into white light.

The humming given out by the arc produced by alternating currents, and even feebly by continuous currents, is a slight drawback to the electric light.

The Lontin Company, Paris, furnish all apparatus and materials for the light, but retain the ownership of them, and charge 50 centimes per hour for a light equivalent to 100 gas jets, on being guaranteed the requirement of a certain number of years. A merchant of the Louvre states that Jablochkoff's candle gives him more light at 30 per cent. less cost.

A diffused and uniform light, carefully kept in by closed apertures and shutters, is to be aimed at in electric illumination. At present, in street lighting by electricity, half the light is lost in the sky overhead instead of being reflected on to the pavements.

THE CHELSEA VESTRY have deputed their surveyor to report fully upon the subject of the electric light as a substitute for gas, and authorised him to proceed to Paris to study it there.

IT is not unlikely that the electric light will abolish the practice of rouging the cheeks, so common amongst the ladies of Paris. White and red paint is exhibited in all its garishness by the pure white beams of Jablochkoff, and the spurious beauties of the boulevards in all their borrowed plumes are pitilessly exposed.

AN electric light for navigating purposes has been tested on the Ohio River, U. S. A head-light illuminated the entire river some distance ahead, while four other lights were placed so as to light the cabin and deck.

THE Dundee Town Council have under consideration a proposal to light the town by electricity, the motive power being derived from the "Reekie Linn," a waterfall in the neighbourhood.

IN addition to the Place and Avenue de l'Opera, and the Louvre, the Jablochkoff light is now regularly installed in the Magasins du *Bon Marché*, the Salle du Chatelet, the Hippodrome, Cours-la-Reine, &c., &c., Paris. M. Grenet has successfully exhibited for over a month at the *Hotel des Deux-Mondes*, Rue d'Antin, an electric light supplied by battery power. A new light, by M. Delaporte, is also announced.

THE ELECTRIC LIGHT IN AMERICA.—The Cleveland (Ohio) *Herald* lately witnessed a trial of the electric light at the establishment of the Union Steel Screw Company, in that city. The apparatus used has been constructed for the illumination of a large carpet mill in Philadelphia. It consists of a Brush dynamo-electric machine of 12,000 candle power, arranged to give four separate currents, each running an electric lamp of 3000 candle power. Two of the lamps were placed on the third floor, and two on the fourth floor of the immense building, and when the engine was started up the machine started at the same time, and, without the slighest manual interference, the lamps flashed out their light in all its magnificence. The effect was most brilliant. The rooms were flooded with a pure white light, like the light of the sun, and it streamed out at all the windows, illuminating houses and streets for a long distance in every direction. The light was very uniform and steady, free from the flickering that used to be an accompaniment of electric light, and, considering the enormous illuminating power, the light was unexpectedly soft and endurable to the eyes. An opportunity was afforded to test the character and whiteness of the light. Worsteds, scarfs, afghans, &c., of brilliant shades, were hanging against the wall at one side of the room, and it was noticed that the colours were brought out as clearly as by the full light of the sun. Estimates were made as to the amount that the light furnished by this apparatus would cost, if used by the Screw Company as it was used on this occasion, and it was ascertained that the total cost of the whole light from the four lamps, including the items of consumption of carbon in the lamps, interest on the investment, and wear and tear, would not exceed 30 cents an hour. The light produced was photometrically equal to 800 gas burners burning 5 feet of gas per hour each. This amount of gas would cost 8 dollars per hour.—*Scientific American.*

A LARGE carpet factory in Philadelphia has also been illuminated by the Brush machine recently.

EDISON'S MICRO-TASIMETER. — Mr. Edison was recently visited at his home in Menlo Park, by Profs. Brackett and Young, of Princeton College, and Prof. Barker, of the University of Pennsylvania, who were desirous of examining his instrument for measuring heat. Mr. Edison has made several experiments with this apparatus, and has succeeded in measuring the fifty-thousandth part of a degree of heat. Prof. Young

and Prof. Brackett will go to Colorado to observe the solar eclipse, and the usefulness of this instrument for measuring the heat of the heavenly bodies will then be tested for the first time.—*The New York Tribune.* (A full account of the micro-tasimeter is given on another page.)

THE TELEPHONE AND THE POSTMASTER-GENERAL.—Messrs. Ashurst, Morris, and Co. write, from Old Jewry, to call attention to the Government Telegraphs Bill, 1878. Clause 3 of this Bill seeks to extend to telephones the monopoly already possessed by the Postmaster-General with respect to telegraphs, and Messrs. Ashurst say:—"If the Bill should pass into law it will practically amount to a confiscation of the invention of the telephone without compensation, notwithstanding that the inventor has obtained letters patent, and that a large amount of capital, to say nothing of time and study, has been expended upon it, and all this upon the faith of the existing law, which confers no such monopoly on the Postmaster-General. It is hardly necessary to point out that Parliament never interferes with vested interests without compensation, and this principle was fully recognised when the Telegraphs Act, 1869, was passed. That Act enabled the Postmaster-General to take away the business from the then existing Telegraph Companies, but the Legislature took care to provide that the latter should receive full compensation."

PROFESSOR GRAHAM BELL has also addressed a letter to the newspapers to the same effect, and a petition has been lodged in Parliament by the Telephone Company against the Bill.

THE project of laying a cable to Lundy Island has been for the present abandoned, owing to the owner of the island (Mr. Heaven) claiming the right to remove any of the officials of the telegraphic company who might annoy his family and dependants. The cable might have proved very serviceable to the shipping of the Bristol Channel.

MR. W. ABBOT, of Tokenhouse Yard, has issued a third edition of his "Submarine Telegraph Map of the World." It is published by Messrs. Bates, Hendy, and Co.

A "JOINT PURSE" arrangement, as regards the Indian and Trans-Indian receipts, has been effected between the Eastern Telegraph Company, the Indo-European Telegraph Department of Her Majesty's Indian Government, and the Indo-European Telegraph Company.

INFORMATION has been received by the Cuba Submarine Telegraph Company of the repair of the second cable belonging to the International Telegraph Company, between Havana and Key West, thereby restoring duplicate communication with the West Indies, Panama, and Demerara.

THE acquisition of Cyprus by the English Government will render direct cable communication between Malta and Cyprus highly desirable, so that we may expect ere long to see a cable laid between these two points. The distance from Malta to Larnaca, the chief town in Cyprus, is 970 miles. The cable may possibly be landed at Baffa, the ancient Paphos, at the extreme west of the island, 900 miles from Valetta. Larnacca is already connected by land-line and cable to Latakia on the Syrian coast. If the Euphrates Valley Railway be constructed, it will open up another telegraph route to India *via* the cables from Malta to Cyprus and Cyprus to Latakia. At present the Island of Candia is connected by cables and land lines to Alexandria, Italy, Rhodes, and Constantinople. It is highly probable that Cyprus will soon be similarly connected to Egypt, Malta, and Constantinople.

THE PATENT LAW AMENDMENT BILL.—In reply to a memorial from the Artizans' and Inventors' Committee urging the Government to give its support to Mr. Anderson's Bill for reducing the cost of patents for inventions, the Attorney-General writes to the effect that he cannot support the Bill.

WE have received with pleasure the first number of *L' Electricité*, the newly revived French electrical journal. It is fitting that a great scientific country like France, the fatherland of Ampere, Arago, and Becquerel, should possess an organ specially devoted to the interests of so flourishing a science as electricity, and we wish it all success. The Count du Moncel has accorded it his valuable help, and M. Wilfrid de Fonvielle, whose scientific chronicles have been justly admired, has undertaken the duties of editor.

HATCHING SILKWORMS BY ELECTRICITY.—According to *Galignani*, it appears that M. Duclaux, Professor of Sciences, at Lyons, has discovered a method of hatching the eggs of the silkworm by means of electricity. The account given is not quite clear, but it consists in taking the eggs when not more than two days' old, rubbing them with an electrified brush, and then dipping them in concentrated sulphuric, chlorhydric, nitric, acetic, or tartaric acid, when they will hatch out. Two crops of silk can in this way be obtained from the mulberry in a single season. It may be added that immersion in water at a temperature of 122° Fah. is said to be equally efficacious.

A NEW Magnetic Observatory was opened on July 20, at Pavlovsk, in Russia. It is an *annexe* of the Central Physical Observatory at St. Petersburg. Observations on the usual meteorological and magnetic elements,

and upon atmospheric electricity, terrestrial currents, and radiation will be made there.

SEATS LIT ELECTRICALLY.—At the Paris Exhibtion there are exhibited some "bancs lumineux" or luminous seats for gardens and public places. They are the invention of Dr. Lacomme, of Paris, and their object is to provide seats and benches for public parks and squares with luminous backs so that all the persons sitting on them may be in the light. For this purpose the backs are hollow and faced with ground or opal glass. In the hollow back is fixed an electric light, or it may be a gas or oil lamp.

FLOATING MAGNETS.—In an article to Siliman's American *Journal of Science and Arts*, Professor A. M. Mayer shows how the magnetic configurations built up by small floating magnets under the influence of induction, illustrate the phenomenon of allotropy, isomerism, expansion or solidification of water, the atomic hypothesis, &c. These figures consist of triangles, squares, and polygons, some having smaller internal figures. They were obtained by suspending a cylindrical bar magnet (387 mm. long, by 13 mm. thick) with its north pole some 60 mm. above a water bath, in which a flotilla of sewing-needle magnets were floated by means of corks. The eyes of the needles were south poles, and appeared above the surface of the water. When the north pole of the large magnet is brought down over them, they at once arrange themselves into figures. Some of these figures comprised as many as 20 needles. The eyes of the needles were inked, and impressions of them taken on paper. Some of the figures were more stable than others.

SOMEWHAT similar electrical experiments to the above have been made by M. de Waha, at Luxembourg, France, by means of a Holtz machine. The inductors of the machine are pointed to the surface of a bath formed of water, with a scum of petroleum or other insulating liquid upon it. When the petroleum layer is thick enough, the water charged by induction from the electrified points burst through the oil to the surface with a kind of explosion resembling a volcanic irruption. Sometimes the currents, which are set up on the surface of the bath, assume a peculiar kind of stability.

ELECTRO-MOTIVE FORCE OF SOLUTIONS.—Further experiments of Mr. James Moser demonstrate that, in an element made of two unequally concentrated solutions of the same salt, and with electrodes of the basic metal, for example, two solutions of sulphate of zinc, with zinc electrodes, the current in the liquid always flows from the solution the most dilute to the most concentrated. The zinc within the former dissolves and deposits itself within the latter.

ELECTROLYSIS.—M. Elsässer (*Deut. Chem. Ges. Ber.* XI., 587) has repeated his experiments on electrolysis by means of a magnesium anode. He confirms his previous results (*Ber.* IX., 1818), and shows that the relation between the volume of hydrogen evolved at each pole is independent of the strength of the current, and also within certain limits of the strength of the solution employed.

POLARISATION OF ELECTRODES.—It has been recently shown by M. Lippmann that for an electrode to become depolarised it should be immersed in a solution formed from the metal of which it is itself composed, thus copper is the only metal which is depolarised in sulphate of copper, zinc the only metal which is depolarised in sulphate of zinc. On the other hand, a metal is polarised in solutions made from other metals, thus copper is polarised in a solution of sulphate of zinc, gold, platinum, &c., while zinc is polarised in a solution of sulphate of copper, gold, platinum, &c. M. Lippmann applies this fact to analysis of metals. If, for example, the metal copper be sought for, a negative copper electrode is dipped into the solution under examination, and if it become polarised under a weak current, the solution contains no solution of copper, One $\frac{1}{50000}$ part of sulphate of copper in the solution can be detected by this means.

WINDING ELECTRO-MAGNETS.—A fact likely to be very useful in making electro-magnets has just been communicated to the French Academy of Sciences by M. Jamin, on behalf of M. E. Bisson. It is found by the latter that if in winding the wire on the core of electro-magnets, the wire, after completing a layer be led back *straight* to the point of departure again to begin the next layer, instead of winding the next layer backwards so as to fill up the bobbin by layers wound in reciprocal directions, as is usually done at present, a gain of one-third in magnetic power will be obtained, every other condition being the same. This gain is manifested either in sliding, pulling, or attraction at a distance. The results have been arrived at by experiments on both small and large electro-magnets.

PORTATIVE FORCE OF MAGNETS.—M. Guidi finds that the weight sustained by an ordinary electro-magnet is always one quarter of that sustained by an electro-magnet with concentric tubes when the weight is in contact with the poles. When, however, the weight is at a distance of half a millimetre from the poles the weight supported by the two magnets is the same, and when the distance is increased still more, the portative force of the tube electro-magnet diminishes indefinitely. Tube electro-magnets would, therefore, be no advantage in electro-motor or dynamo-electric machines.

ELECTRICITY IN PHOTOGRAPHY.—M. Bovin has found that collodion films may be easily removed from glass plates by giving them a charge of positive electricity. Collodion films appear ordinarily to adhere to

the plate by reason of their being electrified negatively. By giving them a positive charge therefore they become neutral, and they may be readily stripped off. A negative charge followed by a positive given to the film demonstrates this theory.

WE notice in the *Official Gazette* of the Patent Office, that in the week ending April 30, Mr. Edison obtained six several patents, three for speaking telegraphs, one for a speaking telephone, one for a telephone signal call, and one for a telephone or speaking telegraph. Mr. Edison assigns each of the inventions to the Western Union Telegraph Company.—*The Operator*, U.S.

THERE are 220 public telephone stations in Germany exclusive of thousands of private telephone lines. In Germany, therefore, the Bell telephone has been made a really useful instrument. In England, on the contrary, for some reason or other, it has been very much talked about, but very sparingly employed. And yet England is a country where such a contrivance should be useful if it be useful anywhere. We trust that this condition of things will speedily be improved.

THE Iquique-Arica cable has been repaired.

WE learn from the *Journal of the Telegraph*, that the suit which Mr. E. C. Benedict brought against the "pooling" arrangement of the W. U. Telegraph Company with the A. and P. has been dismissed.

POLO BY ELECTRIC LIGHT.—A novel and successful application of the electric light was carried out on Thursday evening, the 18th July, on the grounds of the Ranelagh Club, at Fulham. A Polo match was played by the members of the club between the hours of nine and eleven, the meadow being illuminated for the purpose by three electric lamps erected on an equal number of stages in different parts of it; the light thus obtained allowing the spectators to follow the course of the ball easily, and the players to see it even more clearly than by daylight. The experiment was considered highly successful, and is likely to be repeated soon. The electric lamps were provided and superintended by Mr. Edward Paterson, of 3, Bedford Court, Covent Garden.

New Patents.

2852. "An improved method of communication by means of electrical currents between the passengers and officials in railway trains and apparatus therefor."—R. W. HAMMOND (communicated by V. von Scheliba).

2816. "Improvements in magnetising metals, or other substances, and utilising same for producing magnetic, electric, telephonic, microphonic, and acoustic effects."—G. E. PRITCHETT. July 13.

2878. "A new or improved electric motor, parts of which are applicable to other electro-magnetic appliances."—E. J. HARLING, H. BULL. July 18.

ABSTRACTS OF PUBLISHED SPECIFICATIONS.

4412. "Electric Lamps."—F. H. ZIFFER. Dated November 23, 1877. 8d. This consists in regulating the carbon points by means of toothed gearing, driven either by the electro-magnetic machine, or the driving shaft. The gearing maintains one or both of the points in a state of revolution round its axis, while at the same time by means of a worm or screw it forces the carbons together as the points are consumed.

4418. "Telephony and telephonic apparatus."—THEODOR WIESENDANGER. Dated November 23, 1877. 6d. This consists of a make and break circuit telephone similar to that of Reiss. (*Not proceeded with.*)

4432. "Improvements in the production and application of electric currents for lighting and other purposes, and in apparatus employed therefor."—J. RAPIEFF. Dated November 24, 1877. 3s. 10d. A full account of this important patent will appear in an early number of the TELEGRAPHIC JOURNAL.

4435. "Electrical apparatus for lighting, &c."—S. A. VARLEY. Dated November 24, 1877. 10d. This consists in improvements on the dynamo-electric machine described in patents No. 3394 of 1866, and No. 1755 of 1867. The mutual reaction machine in question is constructed of bobbins revolving on an axle between the opposite poles of soft iron electro-magnets, a commutator being employed to direct the positive and negative currents generated. The present improvements consist in forming the coils of wooden cores surrounded by iron wires laid parallel to the axis of the core. Over this composite core the bobbin wire is wound. To divide the light, "electric division bobbins" are employed. These are constructed of rings or helices of insulated wire, and layers of iron wire superposed over one another, built up in a similar way to that described in respect to the revolving bobbins, but instead of being wrapped with one continuous length of insulated wire, they are wrapped with two, three, or more insulated wires, side by side, and the insulated wires or helices superposed over one another, are so connected, that when electricity is flowing through the insulated convolutions, the layers of iron wire are magnetised in alternate directions forming armatures or keepers to one another. The separate insulated wires form separate sources of electricity, and are to be connected in circuit with separate lamps.

4464. "Dynamo electric machines."—LOUIS SIMON. Dated November 27, 1877. 4d. This consists in modifying the Gramme machine, so that more of the wire of the armature ring is brought within the magnetic field. (*Not proceeded with.*)

4478. "Preventing collisions on railways."—LUIGI ISIDORO GUANO, of Genoa. Dated November 28. 6d. This consists in arranging at every station or switch an apparatus, whereby the passing train is caused to signal its passage to a point some distance, say several miles ahead on the line, so that a train coming in the opposite direction will know that there is a train advancing towards it, and may stop.

4500. "Electric piles."—G. A. SCHOTH, London. Dated November 29, 1877. 6d. For use in telegraphy, or for medical purposes, these batteries are made of tubes, each tube containing a spiral of copper wire surrounding a zinc rod or pencil enveloped with porous material, containing liquid mercury in its interior to keep the zinc amalgamated. Sulphate of copper solution is the depolariser.

General Science Columns.

IRRIGATION WORKS IN THE DECCAN, BOMBAY.

THE following particulars of some of the largest storage works already completed or under construction in the Deccan will, to some extent, show the magnitude of the principal undertakings in the Bombay Presidency, having for their object the storage of water for irrigation purposes. Works of this character are more expensive, in proportion to the areas for which they are calculated to supply water for irrigation, than ordinary canals, but it must be remembered that they are situated where such canals could not be constructed. The largest work is the Muta reservoir, in the Poona collectorate, which has a storage capacity of 5,226·076 millions of cubic feet, and has been completed at a cost of £261,578. The dam across the river Muta is of masonry, 3,687 feet in length, with a maximum height of 97·84 feet, and having a waste-weir 1,425 feet long. The drainage area from which this tank is supplied is 196 square miles, and the area of the reservoir at full supply level 160,356,000 square feet. The next largest work is the Pangaon Tank, at present in course of construction in the Sholapur collectorate. The drainage area from which this tank is fed is 298 square miles in extent. The tank is retained by means of an earthern dam 15,100 feet in length, and 76·8 feet in maximum height, and with a waste-weir 1,500 feet in length. The area of contour of the Pangaon tank at full supply level is 291,961,000 square feet, and its total capacity 5,020,041,000 cubic feet; the estimated cost of this work is £127,982, being at the rate of £255 per million cubic feet of water stored. The Ekruk tank, also in Sholapur, is a very remarkable work, the dam consisting of an earthen embankment 7,000 feet in length, having a maximum height of 75·66 feet, and a waste-weir 750 feet in length; the drainage area of this tank is 160 square miles, its contour area 202,080,000 square feet, and its available capacity 3,350,030,000 cubic feet. Its cost has been £76,638. The Mhaswad tank, in Satara, which is in progress, has an earthen dam 9,080 feet in length, and 79·79 feet in height, the waste-weir being 3000 feet in length; the drainage area which feeds this tank is 500 square miles; the contour area of the tank, 174,847,000 square feet at full supply level, and its total capacity 3,072,134,000 cubic feet. This work is expected to cost £93,415 when completed. The next largest tank in progress, and the last to which we shall at present refer, has only half the capacity of the one last described; this is the Ashti tank, in Sholapur, which with a drainage area of 92 square miles, and an earthen dam across the river 12,709 feet in length, and 57·75 feet in maximum height, will impound 1,499,470,000 cubic feet of water, having a contour area at its full supply level of 116,610,000 square feet. The waste-weir is 800 feet in length, and the total cost of the work is expected to reach £45,292. These storage works, large as they undoubtedly are, and of modern construction, will not bear comparison in point of size with some of the native tanks to be found in the Madras Presidency and in Mysore. How far works of this character are likely to prove remunerative, or otherwise, is at present a question; but considering their expensive character, it seems hardly probable that they will yield better returns than irrigation canals in other parts of India; and these, as a rule, can hardly be said to be very remunerative. Some of them, it is true, do more than pay interest on their outlay from net receipts, but in many cases their working expenses are not even covered by receipts. Probably, as directly remunerative undertakings, these tanks will not pay, but the indirect benefits they will confer upon the country under their command, may still be such as fully to justify their construction as State works.

THE presidential address of the British Association meeting, which will be held this year at Dublin, will be delivered on the evening of August 14, by Dr. W. Spottiswoode. The two popular evening discourses will, on this occasion, be delivered by two rising men, Mr. G. J. Romanes, whose theme will be "Animal Intelligence," and Professor Dewar who will treat of "Dissociation; or Modern Ideas of Chemical Action."

CANADIAN GRAPHITE.—According to a report by Mr. Hoffman, Montreal, Canadian graphite is fully equal to that from Ceylon for the manufacture of crucibles and similar purposes. It is equally incombustible and free from ash.

SILVERING GLASS.—M. R. Bottger, in the *Deutsche Indust. Zeit.*, gives the following new process for silvering glass which may prove useful for silvering galvanometer mirrors. Tartrate of silver, in very fine powder, is suspended in distilled water, and very dilute ammonia is then very carefully added until the tartrate of silver is dissolved. The operator must satisfy himself that a small excess of the silver salt remains undissolved, and that the liquid gives off no ammoniacal odour. Into this bath the objects to be silvered are placed, after having been carefully cleaned. In about ten minutes they are uniformly covered with a film of silver.

OZONE.—M. Ermine finds that the decomposition of ozone by the light of day takes place slower than in obscurity. Ozone which is allowed to stand some time after its preparation, and is not employed just at once, has a more energetic disinfecting action.

ACOUSTIC REPULSION.—In a closed resonator, a node is formed near the bottom, and the pressure is stronger at the interior than at the exterior: if then, a resonator of paper, or very thin glass, be suspended to a moveable support over a vertical pivot, and furnished with a counterpois, the apparatus will be

repulsed by a sonorous body. The experiment succeeds above all with the resonance box of a diapason, or a plate fixed at its centre. A continuous rotation is attained with four resonators suspended at the arms of a cross-shaped support, and the repulsion can be measured by fixing the resonator to a torsion balance. In a sonorous tube, the pressure, even at the centres, is always a little stronger than the exterior pressure: the air ought, therefore, to escape from the tube. It has been remarked that in the tubes of Kundt, there is a current of air along the axis of the tube, and a current in the contrary direction along the walls. This emission of air from a sounding tube is proved by placing a resonator filled with smoke in front of the resonance box of a diapason, when the smoke will escape from it. This current of air when the tube is placed before the centre of a vibrating plate will disperse lycopodium powder. When a conical resonator open at its two extremities, is put in front of the end of a Kundt tube, the draught will blow a candle flame, or turn a light mill.

AMERICAN ELECTRO-PLATING.—Local electro-plate manufacturers are much exercised over the introduction of American productions in their specialty, which has up till recently been free from transatlantic competiton. I am informed by several local employers that American electro-plate is undoubtedly finding a ready sale in this country; but that it is "Britannia metal electro-plated," and that instead of calling it "soft metal" to distinguish it from nickel silver electro-plate, as English manufacturers do, the Americans designate it "hard white metal," which has induced dealers to purchase it, under the impression that they were getting "hard metal" ware, *i.e.*, nickel silver electro-plate.—*Sheffield Correspondent of the Engineer.*

THE Chinese make a concentrated essence of wine which, dissolved in water, makes an excellent beverage.

IT is proposed to erect light bridges across the Paris boulevards, at the most thronged points. Something of the kind would be a convenience in many parts of London.

M. MOUCHOT, the French apostle of solar cooking, is at present making coffee, distilling wine, and roasting beef by the reflected sunlight, in the grounds of the Paris Exhibition.

TASMANIAN COPPER.—A promising discovery of copper ores has been made at Badger Head, on the north-west coast of Tasmania, about seven miles from Tamar Heads. A company with a nominal capital of £20,000 has been formed to work three sections of 80 acres each. An application for a fourth section has been made, which will make the total area to be held by the company 320 acres. Several assays of ore taken from the lode show upwards of 27 per cent. of copper.—*Engineering.*

City Notes.

Old Broad Street, July 30th, 1878.

THE meeting of the Globe Telegraph and Trust Company is being held as we write, and as the meetings of the Anglo American and the Direct United States Cable Companies do not take place until Friday, we confine ourselves, of necessity, to adverting to the reports. From that of the Globe Company, which is for the year, we find that the net revenue amounts to £154,404 10s. 6d., which with the balance brought forward makes a total of £154,824 10s. 8d. The sum of £115,399 4s. of this amount has been distributed in the *interim* dividend, and the directors have written £500 off the Parliamentary expense account. The directors now recommend payment of a final dividend for the year of 3s. per share on the Preference Shares, and of 2s. per share on the Ordinary Shares, making with the former distribution, a total dividend for the year of 6 per cent. upon the Preference Shares, and 4 per cent. upon the Ordinary Shares, leaving a balance of £425 6s. 8d. to be carried forward. In the next paragraph, the directors express their complacency that their anticipation of an increased revenue arising to the Globe Company "by the cessation of hostile competition between the Atlantic Telegraph Companies," have, "so far," been realised; and they also note with satisfaction, that "the market value of the stocks and shares held by the company show an improvement as against this time last year of about 6 per cent." They are thankful for mercies by no means large. Last year it is true they had the unpleasant duty to perform of telling the shareholders they must put up with a reduction of dividend; but there is nothing we can see, beyond the fact that the dividend is not again to be reduced, that calls for congratulation. Whatever efforts have been made to get rid of Anglos, the holding of the Globe Company is still very great; still, as it was last year, a third of the shareholders' money is invested in that enterprise. We naturally turn to the report of the Anglo-American Company, and the figures we find there are not, we may say, generally of a nature calculated to inspire the belief that the larger the stake of the Globe Company in the Anglo, the better will it be for the Globe shareholders. The dividend is indeed the same as it was last year—be it observed, this is after a clear six months' experience of the amalgamation which was to make the fortunes alike of holders of Anglo and Globe shares—but the total receipts from January to June, less the balance brought over from the last account, are £271,158 as compared with £281,813 in the previous half year; while the total expenditure is £44,265 as compared with £42,591. Attention is called to an increase in the traffic receipts, which is, of course, assigned to the circumstance of the 3s. rate being in force. The sum of £75,000 has been properly added to the reserve fund; but, we repeat, that with such an enormous capital the reserve fund of the Anglo Company should be much increased. There is nothing in the report which will tend to ease the minds of the Globe shareholders. Taking everything to be as it is stated to be, what improvement has the amalgamation really effected in the prospects of either of the companies? We hope this question will be taken up at the respective meetings.

Touching the Direct Company, the dividend in that case also remains stationary. But the directors affirm that that is in deference to the wishes of the shareholders, who, it is averred, desired that the dividend should not be increased beyond 5 per cent. until a substantial reserve fund is established. The shareholders are right in so desiring, and it is satisfactory that £32,155 has accordingly been added to the fund. It

might have conduced to the benefit of the shareholders if the directors of this and other cable companies had arrived some time back at the conclusion that it is "a primary duty" for them "to secure as far as possible the permanency of the property by the practical guarantee of a substantial reserve fund against the contingencies of breaks and competitions." Over and over again this duty has been drummed by us into the ears of all concerned, and until recently it has been as persistently ignored. There are several things in the Direct report which will probably engage the attention of the shareholders' meeting. For instance, the directors are still restless for an extension of the amalgamation scheme. Thus they hope that negotiations now proceeding between the Direct and the Dominion Telegraph Company "will terminate all existing difficulties with that Company and result in a supplemental working agreement beneficial to both companies." This is a matter which, we apprehend, requires discussion. What is the nature of the proposed supplemental working agreement? The shareholders will be to blame if they allow the directors to enter into another combination without a complete understanding. What benefit are they reaping from the combination that was formed for them with the Anglo Company?

At the recent meeting of the Eastern Telegraph Company, the proceedings were almost entirely of a formal character. Mr. Pender reviewed the progress made by the Company during the past year; and the report was unanimously agreed to, as also the agreement between the Indo-European and the Eastern Company, which was specially put to the meeting. We observe that the chairman, in alluding to the fact that the revenue of the company for the past half-year was smaller than that for the corresponding period in 1877, attributed the decrease to the cessation of the Russo-Turkish war. No doubt that is so; and other companies have found their revenue to have diminished from the same cause. We anticipated that some further explanation would be volunteered at the meeting of the large sum of £26,179, mentioned in our last issue as being set down under the head of "Special Expenditure," than was offered. No less than £21,736 of the amount was, the chairman stated, expended in repairing and altering the Lisbon and Vigo cables; but it would surely have been interesting to some of the shareholders to have learned whether the £12,104 "ship's expenses" represents any part of the cost of the directors' trip to the Mediterranean, or whether those gentlemen defrayed their own expenses. They ought to have the credit of generosity, if they have been generous; but if they have charged the company with the cost of the excursion, the shareholders, one would think, would, for their guidance in the future, like to know what sum was actually absorbed in the affair. Nor should the £1,556 for repairing cables have been included in the special expenditure. We shall lose no opportunity that offers of protesting, on principle, against any charge being made by any company, on capital which ought obviously to be charged to revenue. Railway companies are not the only or the worst sinners in this respect.

The Eastern Telegraph Company (Limited) announces that the coupons on the Five per Cent. Debentures will be payable on the 1st prox. at the banking house of Messrs. Glyn, Mills, Currie, & Co.

The shareholders of the Campanhia Telegraphica Platino Braziliera will hope that the directors' expectation of shortly being in a position to recommend the payment of a dividend will be realised. It will be something even for them to know the "exact state" of their affairs.

We note that the coupons of the Six per Cent. Debentures (Eastern Extension Telegraph Company) is now payable at the Consolidated Bank, and that the half-yearly interest on the A and B Debentures of the Western and Brazilian Company is also payable at the offices of the Company.

The following from the morning papers refers to the Anglo-American Telegraph Company's lost cable:—

"*To the Editor.*

"SIR,—The steamships *Seine* and *Calabria*, which were sent out by this Company at the end of May for the recovery and repair of the 1866 cable, returned to London this morning.

"The cable has been hooked several times, and partially raised to the surface; but the outside iron wires were so weak from the effects of oxidation that, its repair was considered impracticable by the engineers in charge of the expedition.—I am, Sir, your obedient servant.

"H. WEAVER, General Manager.

"Anglo-American Telegraph Company (Limited),
"26, Old Broad-street, London, E.C., July 27."

The following are the latest quotations of telegraphs: Anglo-American, Limited, 35-36; Ditto, Preferred, 61¾ 62¼; Ditto, Deferred, 91-92; Black Sea, Limited, 2-3; Brazilian Submarine, Limited, 6¾-7; Cuba, Limited, 9¼-9¾; Cuba, Limited, 10 per cent. Preference, 17-17½; Direct Spanish, Limited, 1⅝-2¼; Direct Spanish, 10 per cent. Preference, 9½-10; Direct United States Cable, Limited, 1877, 13⅞-14⅛; Eastern, Limited, 7⅞-8; Eastern, 6 per cent. Debentures repayable October 1883, 108-111; Eastern 5 per cent. Debentures, repayable August 1887, 103-105; Eastern 6 per cent. Preference, 11¾-12; Eastern Extension, Australasian and China, Limited, 7⅞-8; Eastern Extension, 6 per cent. Debenture, repayable February, 1891, 109-112; German Union Telegraph and Trust, 8½-9; Globe Telegraph and Trust, Limited, 5⅛-5⅜; Globe 6 per cent. Preference, 11-11¼; Great Northern, 8¾-9; Indo-European, Limited, 20-21; Mediterranean Extension, Limited, 3-3⅛; Mediterranean Extension, 8 per cent. Preference, 9¾-10¼; Reuter's Limited, 10-11; Submarine, 225-230; Submarine Scrip, 2-2¼; West India and Panama, Limited, 2⅜-2⅝; Ditto, 6 per cent. First Preference, 8½-9; Ditto, ditto, Second Preference, 8¼-8¾; Western and Brazilian, Limited, 4½-4⅝; Ditto, 6 per cent. Debentures "A," 98-101; Ditto, ditto, ditto, "B," 96-99; Western Union of U. S. 7 per cent, 1 Mortgage (Building) Bonds, 116-120; Ditto, 6 per cent. Sterling Bonds, 102-104; Telegraph Construction and Maintenance, Limited, 31¾-32¼; Ditto, 6 per cent. Bonds, 100-103; Ditto, Second Bonus Trust Certificates, 2¾-3; India-Rubber and Gutta-Percha and Telegraph Works, Limited, 29-30.

We can only very briefly refer to railway matters. Sir Edwin Watkin's scheme of salvation for the East-London Company has fallen through, the Select Committee of the House of Commons having rejected the necessary bill. It remains to be seen whether an alternative plan can be carried through. The dividend of the Metropolitan Company is satisfactory, and for the first time in the history of the District Company, a dividend, though it is but ½ per cent., has been declared on the ordinary stock. But it is the beginning of good things. We are the more inclined to believe this, because the two companies are, at length, acting in harmony, so far at least as the completion of the inner circle scheme is concerned. The Brighton and South Coast shareholders have every reason to be satisfied; the South-Eastern need not grumble; the directors of the Manchester and Sheffield have an extra ¼ per cent. at their disposal; the Great Eastern Company exists. We may hereafter make some comments on the position and prospect of some of the companies.